Gohith Reddy
2/20/2023
Data Analytics

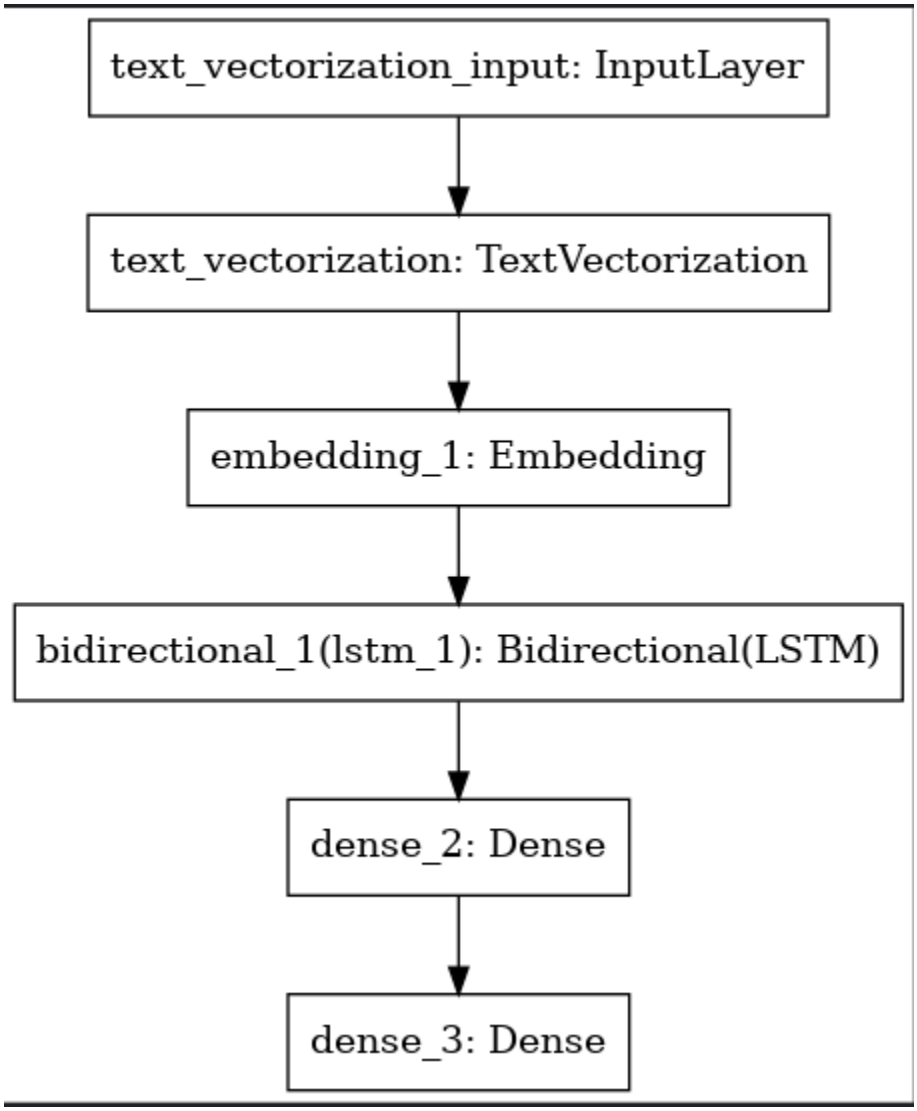
Biases Within Sentiment140

Neural networks are large collections of neurons which are then used to predict based on a dataset. They learn from the dataset, so if the dataset they're using has a bias, the AI will also contain this bias. Sentiment140 and the IMDB reviews dataset are both used within a sentiment analysis AI. These types have multiple uses which can range from classification to helping within research involving Natural Language Processing. This paper aims to study the biases within these databases.

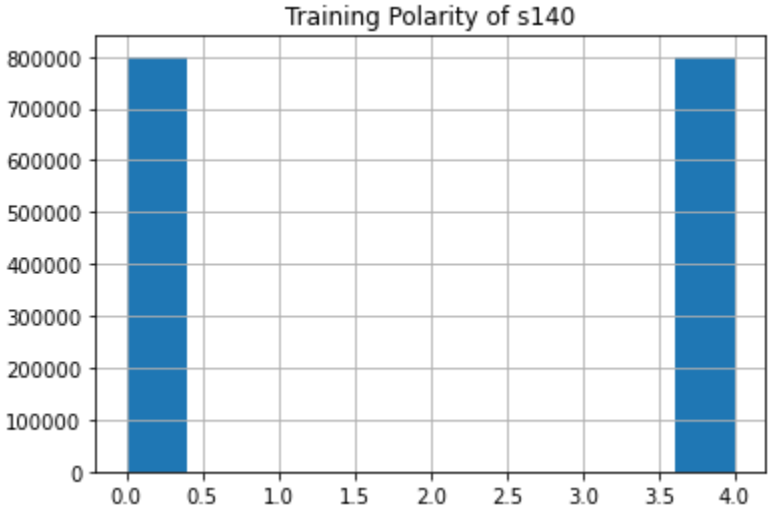
First off, the model uses a Text Vectorizor and an Embedding Layer which then feeds into a Bidirectional LSTM Layer with 64 neurons using ReLU, a Dense layer with 64 Neurons also using ReLU. These feed into a single neuron using sigmoid activation.

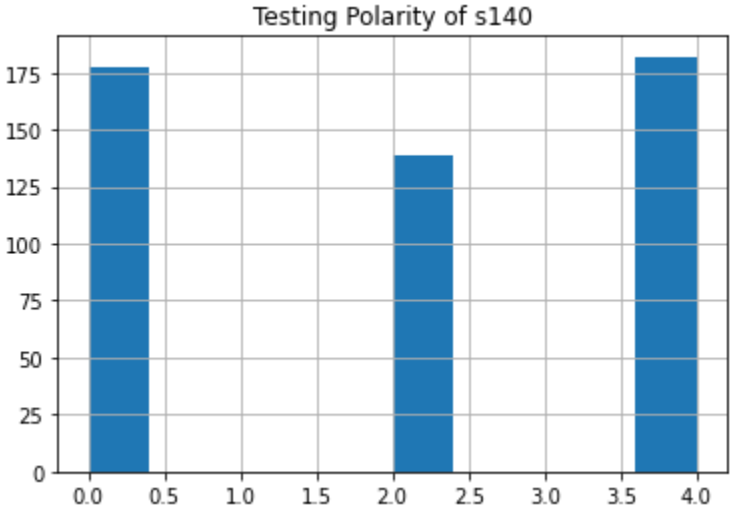
```
def create_model():
    model = tf.keras.Sequential([
        encoder,
        tf.keras.layers.Embedding(
            input_dim=len(encoder.get_vocabulary()),
            output_dim=64,
            # Use masking to handle the variable sequence lengths
            mask_zero=True),
        tf.keras.layers.Bidirectional(tf.keras.layers.LSTM(64)),

        tf.keras.layers.Dense(64, activation = 'relu'),
        tf.keras.layers.Dense(1, activation = 'softmax')
    ])

    model.compile(loss='binary_crossentropy',
                  optimizer=tf.keras.optimizers.Adam(1e-4),
                  metrics=[
                      'accuracy',
                      tf.keras.metrics.FalsePositives(name='fp'),
                      tf.keras.metrics.FalseNegatives(name='fn'),
                      tf.keras.metrics.TruePositives(name='tp'),
                      tf.keras.metrics.TrueNegatives(name='tn')
                  ])
    return model
```

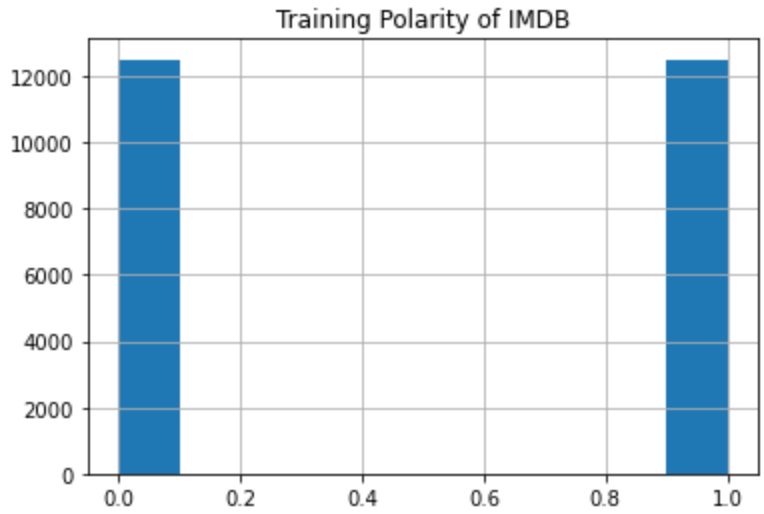
```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
text_vectorization (TextVect (None, 128)               0
_________________________________________________________________
embedding_1 (Embedding)      (None, 128, 64)           54403904
_________________________________________________________________
bidirectional_1 (Bidirection (None, 128)               66048
_________________________________________________________________
dense_2 (Dense)              (None, 64)                8256
_________________________________________________________________
dense_3 (Dense)              (None, 1)                 65
=================================================================
Total params: 54,478,273
Trainable params: 54,478,273
Non-trainable params: 0
_________________________________________________________________
```

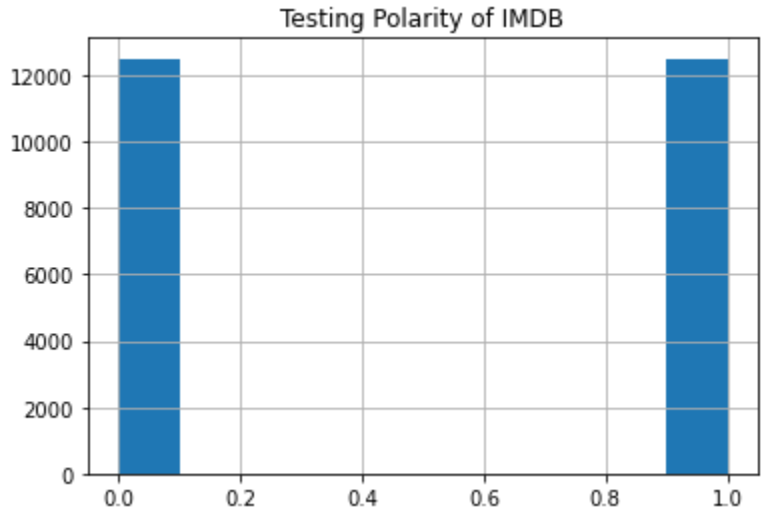


A common bias is the amount of each label within a database.



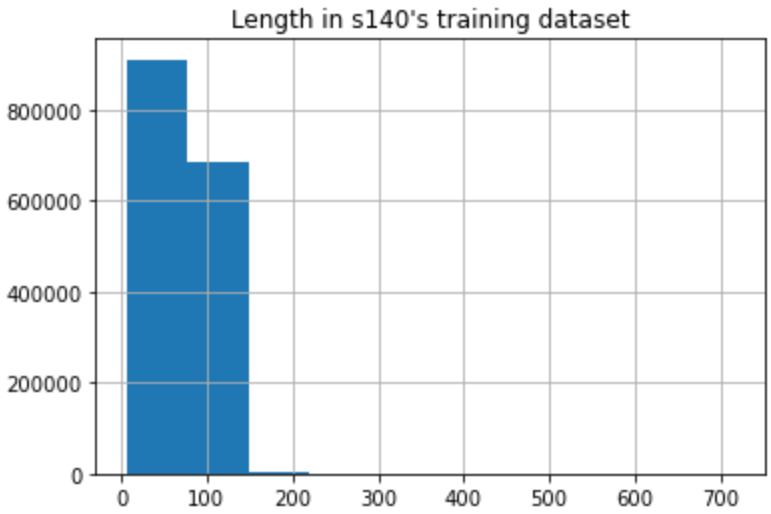


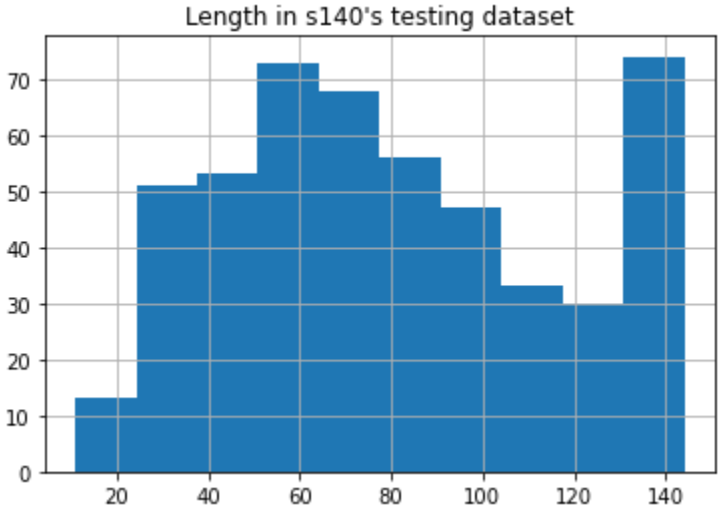


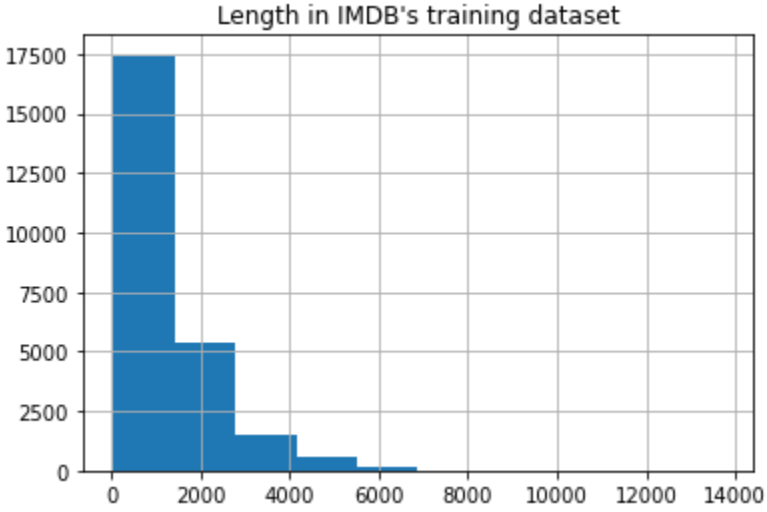


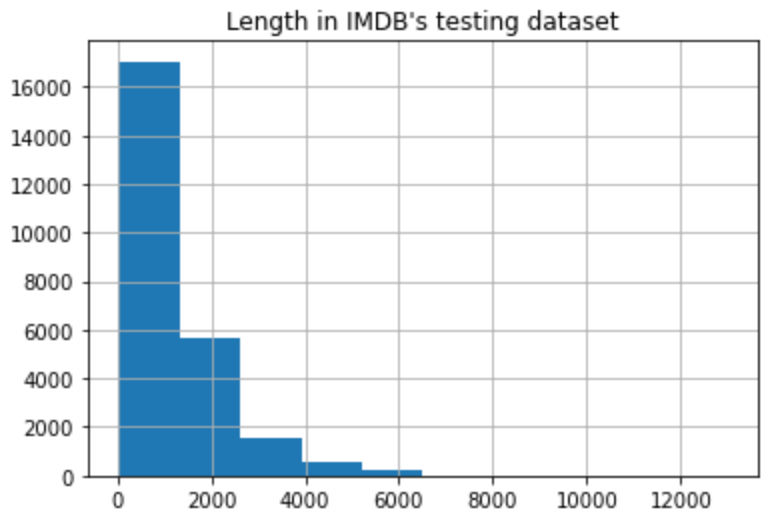
Both IMDB and Sentiment140's training dataset have equal amounts of negative and positive labels. IMDB has a 50-50 split and every label has an equal amount, but sentiment140 has a significantly lower amount of data in it's testing database as well as having a new label within the testing set that's not available within the training. This results in sentiment140 not being as suitable for binary sentiment analysis. Both IMDB and sentiment140 don't lean either to the negative or positive label.

Within sentiment analysis since you have to predict from text, the text has length which means that the models trained on these datasets are likely going to be worse when trying to predict text outside their comfortable size. Another correlation that could be found is if length has any correlation to if the text is positive or negative. Shorter reviews such as "It was very enjoyable" are expected to be positive and more generic as opposed to someone going on a long rant.

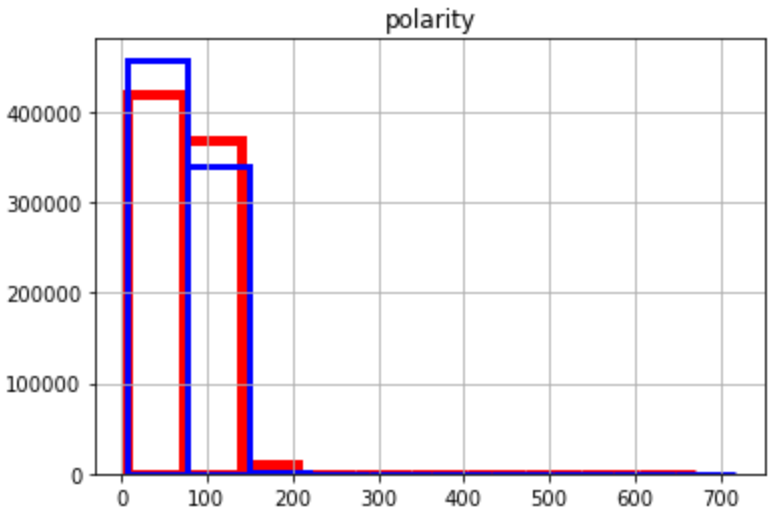

Length in s140's training dataset
800000
600000
400000
200000
0
0
100
200
300
400
500
600
700

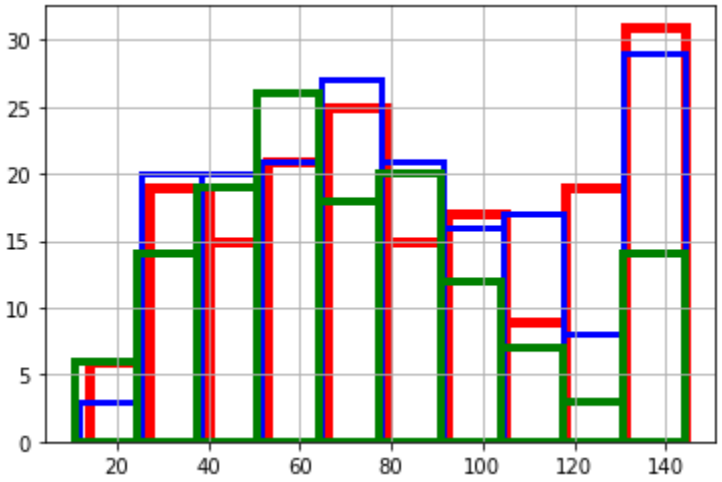

Length in s140's testing dataset
70
60
50
40
30
20
10
0
20
40
60
80
100
120
140

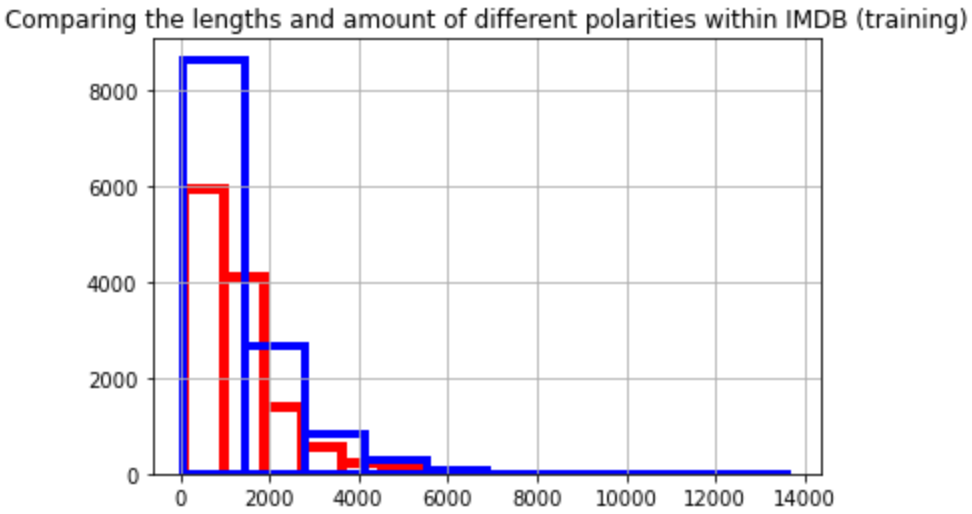

Length in IMDB's training dataset
17500
15000
12500
10000
7500
5000
2500
0
0
2000
4000
6000
8000
10000
12000
14000

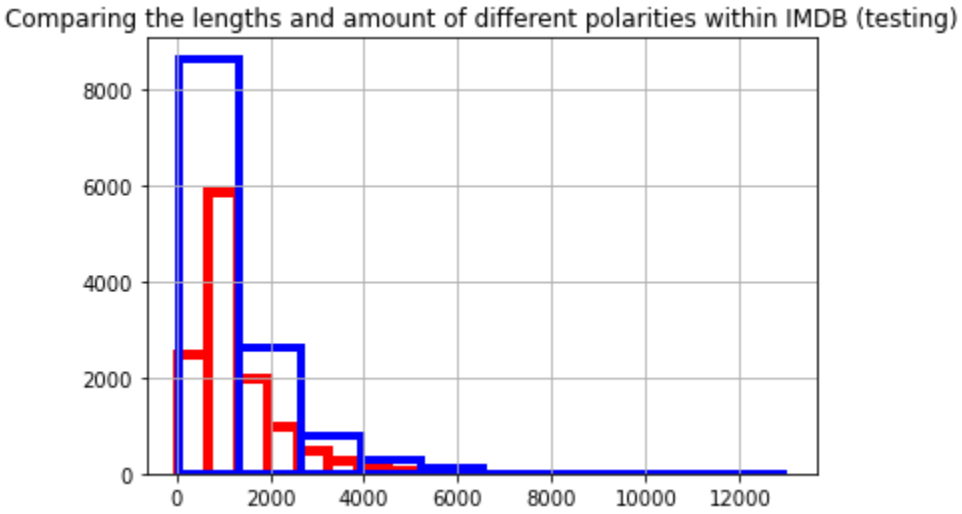


IMDB has much larger samples than sentiment140. Sentiment140 is extremely concentrated within the range of 0-100 characters, so it will likely be horrible at any text over 100 characters. This could be somewhat mitigated through the use of splicing every 100 or so, but this will likely not be able to get the overall connotation of the entire piece. Now onto the correlations between length and polarity


polarity
400000
300000
200000
100000
0
0
100
200
300
400
500
600
700


30
25
20
15
10
5
0
20
40
60
80
100
120
140





In sentiment140, there is very little correlation between polarity and length. It tends to be slightly more positive when under about 80 characters, but more negative over. The IMBb graphs seem roughly equal, because the negatives have more “bins” to put themselves into so it looks less at every length.

I trained the model on the sentiment140 dataset for 1 epoch in order to see the results. I was not able to train it for longer due to time constraints. What follows the the output from trying to predict the printed sample sentences:

Minecraft is such a good game
the sentiment is [0.6759199] for the sentiment140 model

I actually despise tall people
the sentiment is [0.5597734] for the sentiment140 model

I love this show
the sentiment is [0.6210745] for the sentiment140 model

I hate everyone and anyone who are more talented than me in any way.The Industrial Revolution and its consequences have
been a disaster for the human race. They have greatly
increased the life-expectancy of those of us who live in
“advanced” countries, but they have destabilized society,
have made life unfulfilling, have subjected human beings
to indignities, have led to widespread psychological suffering (in the Third World to physical suffering as well) and
have inflicted severe damage on the natural world. The
continued development of technology will worsen the situation. It will certainly subject human being to greater indignities and inflict greater damage on the natural world,
it will probably lead to greater social disruption and psychological suffering, and it may lead to increased physical
suffering even in “advanced” countries.
the sentiment is [0.9978436] for the sentiment140 model

Hello everyone,
I want to take a moment to talk about the power of motivation. Motivation is the driving force behind every success story. It's the spark that ignites the flame of determination, the fuel that keeps us going, and the inspiration that propels us forward.

No matter what your goals or aspirations may be, it all starts with motivation. Whether you're striving for a promotion at work, training for a marathon, or simply trying to live a healthier lifestyle, motivation is what will get you there.

But staying motivated isn't always easy. There will be times when you feel like giving up, when the road ahead seems too long, or when you face obstacles that seem insurmountable. But remember, it's during these times that your motivation is truly put to the test.

It's important to keep in mind that motivation is not something that just happens to you. It's something that you create within yourself. You need to be the one who fuels that fire, who keeps that determination burning bright.

One of the best ways to stay motivated is to keep your eye on the prize. Visualize what it is that you want to achieve, and keep that image in your mind's eye. Let it be a

constant reminder of what you're working towards, and why you started in the first place.

Another key to staying motivated is to surround yourself with positive people. Seek out individuals who support and encourage you, and who will cheer you on when you're feeling discouraged. These people will be your biggest advocates, and will help you to stay focused on your goals.

So remember, motivation is the key to success. It's what separates those who achieve their dreams from those who fall short. So stay focused, stay determined, and never give up. With hard work, dedication, and a little bit of motivation, you can accomplish anything you set your mind to.

Thank you.
the sentiment is [0.19850135] for the sentiment140 model

What is wrong with people? How can anyone think that wearing socks with sandals is a good idea? It's a complete and utter fashion disaster that should never be attempted.

Let me break it down for you: socks and sandals serve completely different purposes. Socks are meant to keep your feet warm and protect them from friction, while sandals are supposed to allow your feet to breathe and provide airflow. These two things simply do not go together, and anyone who thinks otherwise is completely clueless.

And let's talk about the aesthetic of this abomination. Socks and sandals look terrible together. Sandals are supposed to showcase the natural shape and beauty of the foot, but when you add socks to the mix, you completely ruin the look. You end up with a lumpy, shapeless mess that is not only unflattering but also embarrassing to look at.

On top of all that, wearing socks with sandals is just plain confusing. Sandals are typically associated with casual outdoor activities, the beach, or the pool, while socks are more suited to colder weather or formal occasions. Combining the two just doesn't make sense and creates a disjointed look that's confusing to everyone around you.

And don't even get me started on the message that wearing socks with sandals sends to others. It communicates a complete lack of concern for fashion and tells the world that you're just too lazy to care. It's a terrible message to send and makes you look like a complete slob.

So please, for the love of all that is good and holy, stop wearing socks with sandals. It's a fashion mistake of epic proportions, and anyone who does it deserves to be ridiculed and shamed. Let's all just agree to leave this trend in the past where it belongs and move on to more fashionable choices.
the sentiment is [0.99795437] for the sentiment140 model

The wild inaccuracies are likely due to the lack of epochs, but even so it’s inaccurate for longer form texts.